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Campbell et al.

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(54) **ROTARY CUTTING DECK HEIGHT OF CUT ADJUSTMENT MECHANISM**

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A01D 34/835	(2006.01)
A01D 34/74	(2006.01)
A01D 34/82	(2006.01)

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CPC A01D 34/54; A01D 34/74

USPC ..... 56/17.2, 17.1, DIG. 22, 249, 294, 15.2, 56/7; 280/43.13, 43.14, 43.15, 43.16, 280/43.17, 43.2, 43.21

See application file for complete search history.

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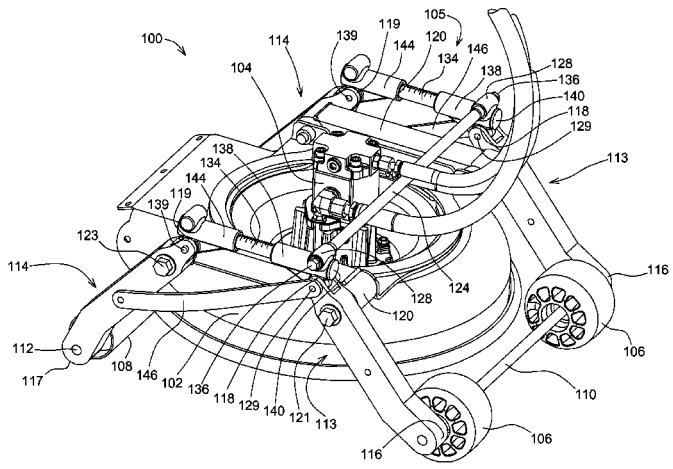
(57) **ABSTRACT**

A rotary cutting deck height of cut adjustment mechanism includes a front pair of height of cut arms and a rear pair of height of cut arms, each height of cut arm pivotably mounted at an angle to a rotary cutting deck. A height of cut rod extends between a front height of cut arm and a rear height of cut arm on each side of the deck. A height of cut adjustment screw is rotatable to extend or retract each height of cut rod. A linkage is provided between the pair of height of cut adjustment screws, so that the angle of the height of cut arms may be adjusted from a single point.

7 Claims, 4 Drawing Sheets



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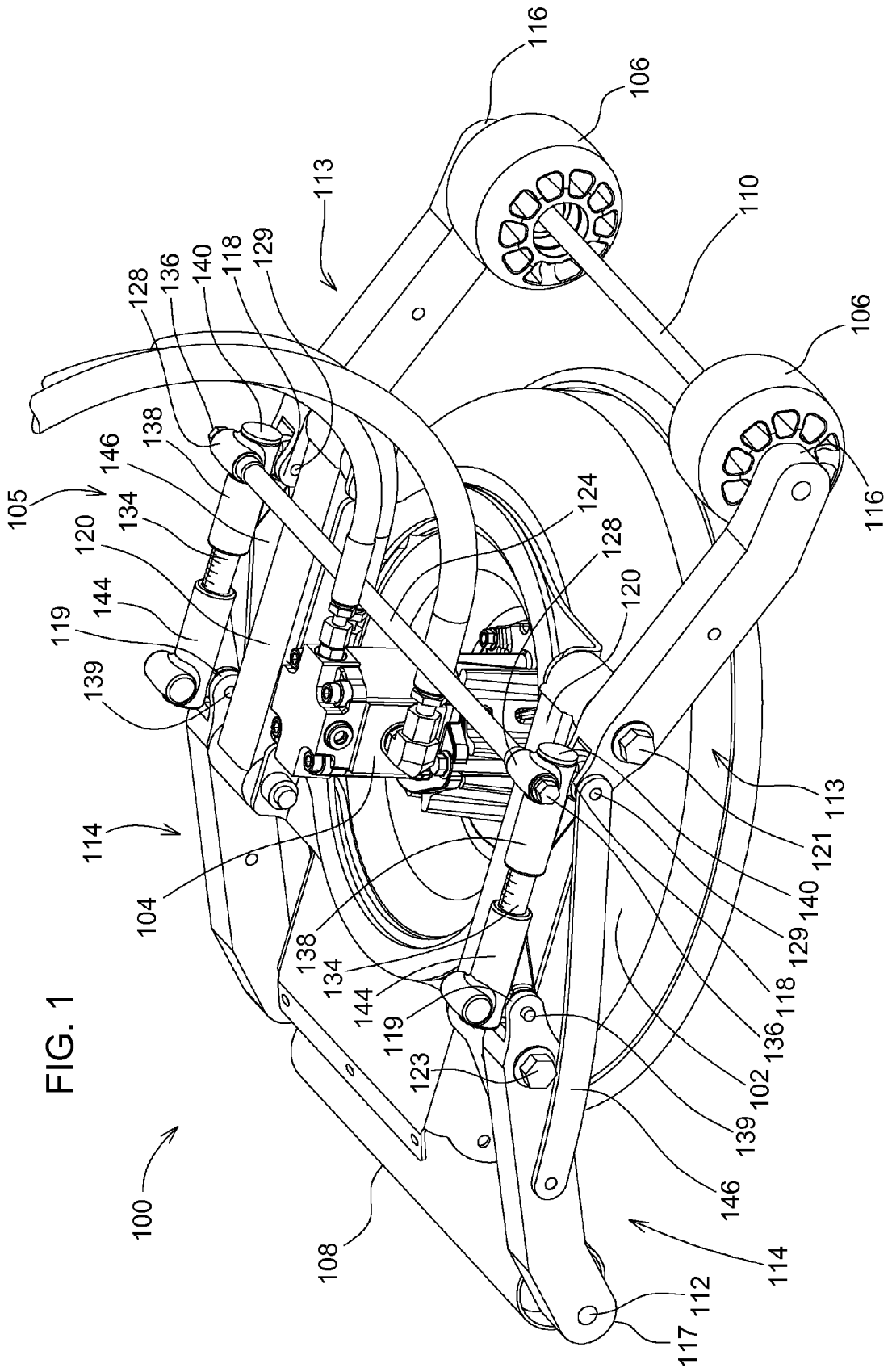
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FIG. 1

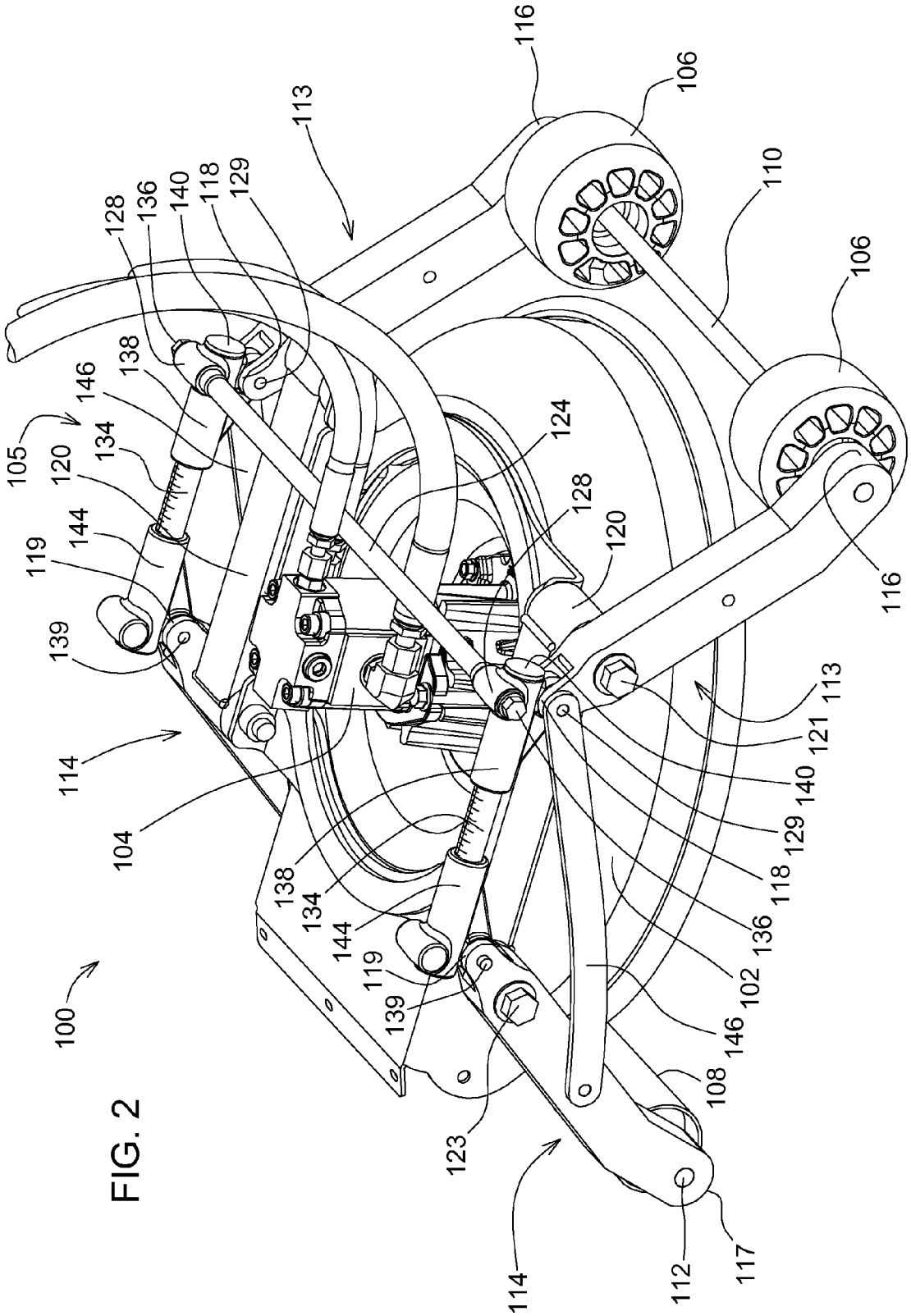
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FIG. 2

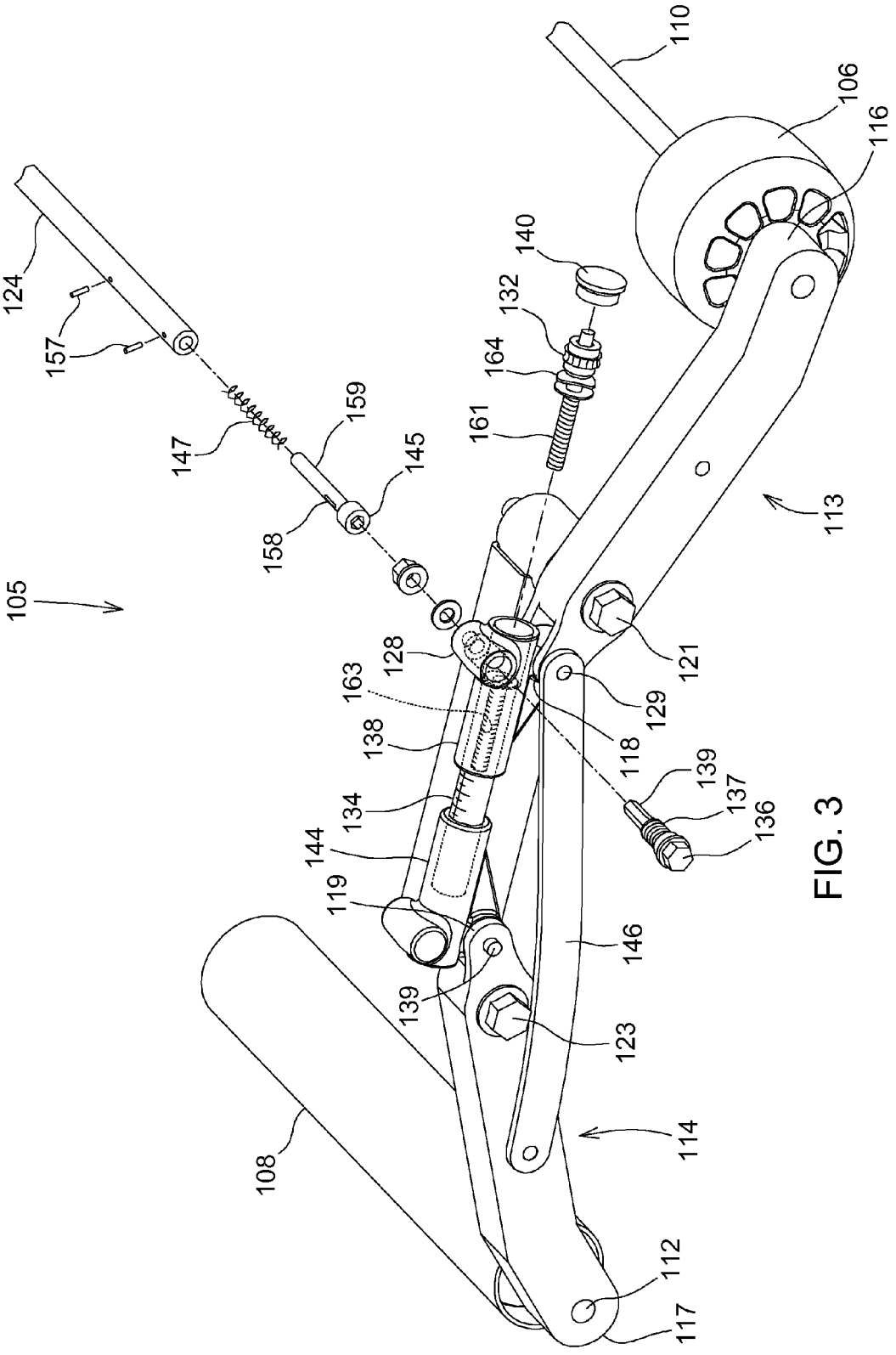
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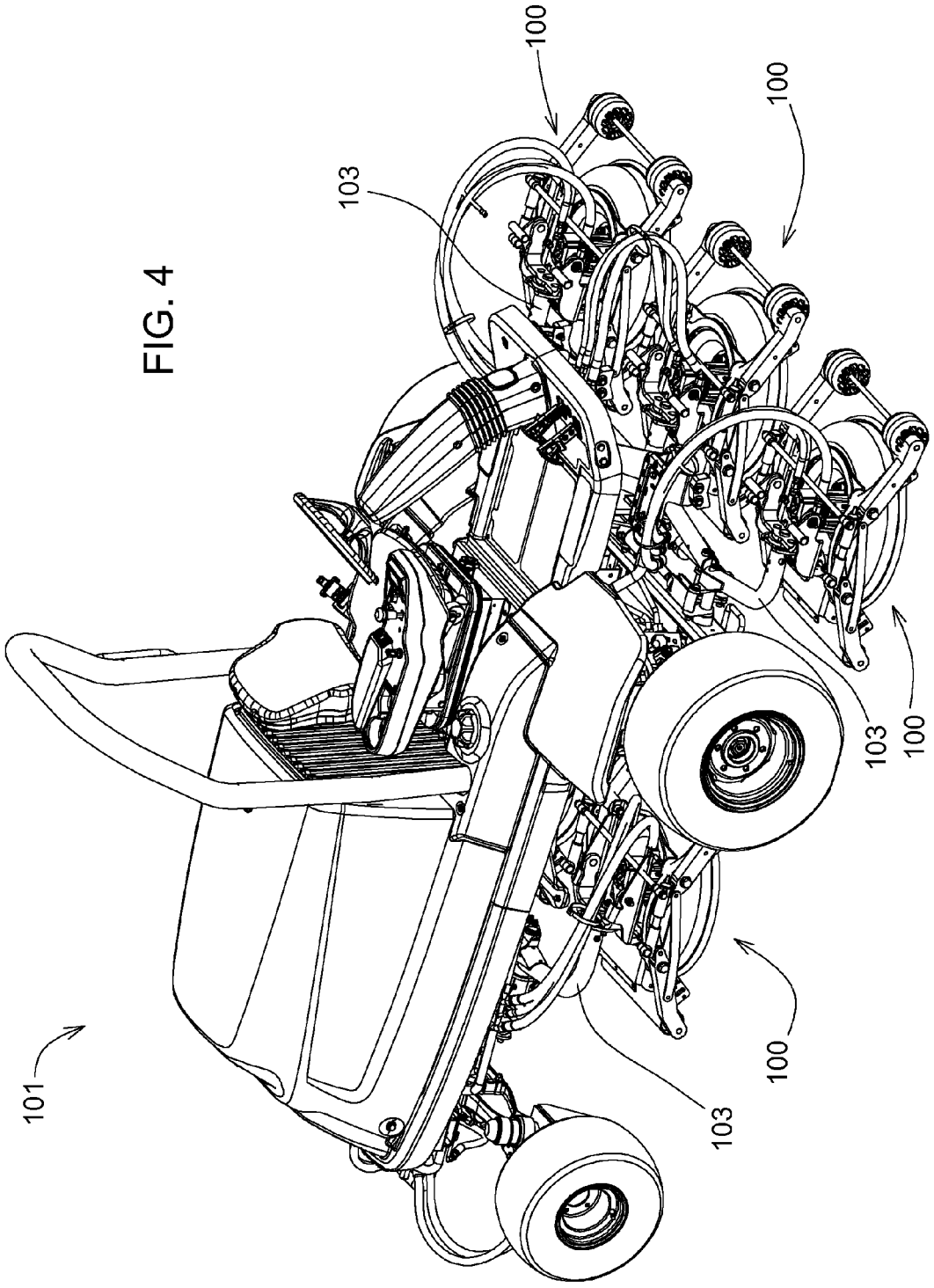
FIG. 3

FIG. 4



ROTARY CUTTING DECK HEIGHT OF CUT ADJUSTMENT MECHANISM

FIELD OF THE INVENTION

The present invention relates to grass mowing machines for golf course roughs, and more specifically to a rotary cutting deck height of cut adjustment mechanism.

BACKGROUND OF THE INVENTION

Many new and existing golf courses have narrowed their fairways and expanded their rough areas on either side of the fairways. Roughs require less care than fairways, so narrowing the fairways allows golf course operators to lower their maintenance costs. For example, irrigation requirements may be reduced if only the fairways are watered. If grasses in the roughs are allowed to grow longer, those non-irrigated areas are less brown. Trees and other aesthetic features may be located in the roughs, because roots and shade can inhibit turf growth in the fairways.

However, golf course roughs still must be maintained regularly using grass mowing machines that can mow the vegetation at an acceptable length and appearance. Equipment for mowing golf course roughs typically includes a traction vehicle carrying three or more rotary cutting decks, each rotary cutting deck mounted on the end of a lift arm extending from the traction vehicle. Carrying the rotary cutting decks with lift arms extending from the front or sides of the traction vehicle is necessary and desirable, instead of towing the rotary cutting decks behind the vehicle, because it is necessary for the mower to provide close trims next to trees, bunkers or other hazards. Each lift arm also may be used to move a rotary cutting deck between a mowing position and a transport position. The mounting devices also should allow for pitch (front to back pivoting) and yaw (side-to-side pivoting) of the rotary cutting decks.

Traction vehicles carrying several rotary cutting decks may travel at speeds of 6 to 8 miles per hour when mowing golf course roughs. The traction vehicle's weight may be in excess of 2000 pounds. Each rotary cutting deck may be subject to shocks from impacts against the ground surface or objects during mowing. To withstand the rigorous mowing conditions, rotary cutting decks typically are made of thick sheet steel, such as 7 gage or 10 gage sheet steel. Each rotary cutting deck may have a diameter between about 18 inches and 27 inches, weigh at least 120 pounds, and may have a cutting blade rotated by a hydraulic or electric motor.

Golf course operators sometimes need to change the height of cut of rotary cutting decks on a rough mower. For example, the height of cut may need to be changed if the mower goes from an intermediate rough with a 1½ to 2 inch height of cut, to a full length rough with a 3 to 4 inch height of cut. The height of cut also may need to be changed if the machine is used to mow rough for tournaments where rough heights can be as long as 6 inches. Additionally, golf course operators may change the height of cut of a rotary cutting deck due to seasonal variations, shade conditions, or different types of grass or vegetation in different rough areas of a golf course.

Rotary cutting deck height of cut adjustment mechanisms may include side plates having a vertically-spaced series of holes, and bolts extending through the holes to secure the deck to the side plates. The deck height may be adjusted by changing the holes in the deck plates and/or the holes in the side plates through which the bolts extend. Other rotary cutting deck height of cut adjustment mechanisms include spacers that may be stacked on several pins that support the deck on a frame, or on casters that are mounted in vertically oriented sleeves. Changing height of cut using the holes or spacers at each of four adjustment points can be cumbersome and time consuming.

U.S. Pat. No. 7,716,907 assigned to Deere & Company of Moline, Ill. relates to a rotary cutting deck height of cut adjustment mechanism for that includes a front pair and a rear pair of height of cut arms, and an axle extending between each pair. Each of the four height of cut arms may be pivoted to support the mower deck at different cutting heights, and each has a notch lock that may be moved between a locked position and an unlocked position at each cutting height. A lever may be used to push each notch lock from an unlocked position to a locked position or pull the notch lock from a locked position to an unlocked position. This height of cut mechanism eliminates the holes or spacers, but the notch locks must be cleaned or maintained periodically to remove debris and loosen the joints, release the lever and clean out the grooves. A rotary cutting deck height of cut adjustment mechanism is needed that is faster and more efficient to adjust cutting heights, reduces maintenance and is low in cost.

SUMMARY OF THE INVENTION

A rotary cutting deck height of cut adjustment mechanism includes a front pair of height of cut arms and a rear pair of height of cut arms supporting a rotary cutting deck, and at least one height of cut adjustment screw that may be rotated to simultaneously change the angle of the height of cut arms.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a rotary cutting deck height of cut adjustment mechanism at a first cutting height according to a first embodiment of the invention.

FIG. **2** is a perspective view of a rotary cutting deck height of cut adjustment mechanism at a second cutting height according to a first embodiment of the invention.

FIG. **3** is a partially exploded perspective view of a rotary cutting deck height of cut adjustment mechanism according to a first embodiment of the present invention.

FIG. **4** is a perspective view of a traction vehicle having several rotary cutting decks mounted on lift arms extending from the vehicle, each with a rotary cutting deck height of cut adjustment mechanism according to a preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIGS. **1** and **2**, in a first embodiment, rotary cutting deck **100** includes a circular inverted dish-shaped cutting chamber **102**. A motor such as hydrostatic motor **104** may be mounted to the rotary cutting deck. The motor turns a cutting blade attached to a generally vertically aligned spindle under the deck. The rotary cutting deck may be supported over the ground surface by ground engaging members at the front and rear of the deck, such as front pair of rollers **106** and rear roller **108**.

In one embodiment, as shown in FIG. **4**, three or more rotary cutting decks may be mounted to traction vehicle **101**. Each rotary cutting deck **100** may be pivotably supported at the end of a lift arm **103** which the operator may actuate with one or more hydraulic cylinders or electric lift mechanisms to raise or lower the rotary cutting decks between mowing positions and transport positions.

In one embodiment, one or more rollers, casters or wheels **106** may be rotatably mounted to and supported by axle **110** at or near the front of the rotary cutting deck. Alternatively, other ground engaging members such as a roller, caster or wheel may be independently mounted to each front height of cut arm **113**. One or more rear rollers **108** may be rotatably mounted to and supported by internal shaft or axle **112** at or adjacent the rear of the rotary cutting deck. Alternatively, the rear of the rotary cutting deck may be supported by an axle with one or more casters or wheels. Or other ground engaging members such as a roller, caster or wheel may be independently mounted to each rear height of cut arm **114**.

In one embodiment, height of cut adjustment mechanism **105** may include a front pair of height of cut arms **113** and a rear pair of height of cut arms **114**. The height of cut adjustment mechanism may be used to change the angle of the height of cut arms from a single adjustment point by pivoting the front and rear pairs of height of cut arms simultaneously. Front axle **110** or a roller, caster or wheel may be mounted to each front height of cut arm **113** adjacent a first or lower end **116** of the arm. Each front height of cut arm **113** may have a pivot axis **121** located near the second or upper end **118** of the front height of cut arm, pivotably mounting the front height of cut arm to mounting bracket **120** on the rotary cutting deck. Rear axle **112** or a roller, caster or wheel may be mounted to each rear height of cut arm **114** adjacent a first or lower end **117** of the arm. Each rear height of cut arm **114** may have a pivot axis **123** located near the second or upper end **119** of the rear height of cut arm, pivotably mounting the rear height of cut arm to mounting bracket **120**.

In one embodiment, height of cut adjustment mechanism **105** may include at least one, and preferably a pair of height of cut adjustment screws **136**. An operator may rotate height of cut adjustment screw **136** with a wrench or power drill and socket to simultaneously pivot the front and rear height of cut arms to change the height of cut. The height of cut adjustment screw may be rotated to extend or retract height of cut rod **134**.

In one embodiment, height of cut adjustment mechanism **105** includes a pair of height of cut rods **134** that extend fore and aft between pivot points at the upper ends of a front height of cut arm and a rear height of cut arm. For example, each height of cut rod **134** may extend between front support **138** and rear support **144**. Front support **138** may be a sleeve shaped casting pivotably mounted at pivot point **129** near the second or upper end **118** of front height of cut arm **113**. Rear support **144** also may be a sleeve shaped casting pivotably mounted at pivot point **139** near the second or upper end **119** of rear height of cut arm **114**. For example, each height of cut rod **134** may be extended or retracted from the supports to simultaneously change the angles of the front and rear height of cut arms. However, one end of the height of cut rod may be fixed with respect to one of the pivot points and/or supports, or may be integral with one of the supports.

In one embodiment, height of cut adjustment screw **136** may be rotated to increase or decrease the length of height of cut rod **134** between the front height of cut arm and rear height of cut arm. For example, turning height of cut adjustment screw **136** extends or retracts the height of cut rod and changes the angular position of the front and rear height of cut arms. Height of cut rod **134** also may include index markings to provide a visible height of cut indicator for each angular position.

In one embodiment, as shown in FIG. **3**, height of cut adjustment screw **136** may include worm **137** that engages worm gear **132**. Each worm gear **132** may be inserted into front support **138**, and may be covered by cap **140**. Worm gear **132** may be attached to threaded shaft **161** that engages internally threaded portion **163** of height of cut rod **134**. Bellville spring **164** may help the worm gear **132** and threaded shaft **161** to maintain its position in support **138**.

In one embodiment, height of cut adjustment mechanism **105** may include a linkage between a pair of height of cut adjustment screws **136**, with one adjustment screw on the left side of the rotary cutting deck and the other on the right side of the rotary cutting deck. For example, the linkage may be cross tube **124**. Cross tube **124** may be releasably connected to the height of cut adjustment screws on each side of the deck. Each height of cut adjustment screw **136** may be inserted through case **128** which may be part of the same casting as front support **138**.

In one embodiment, each adjustment screw **136** may have a hex head or other engageable end extending out from case **128** that may be engaged and rotated with a tool (i.e., a wrench or power drill socket) to change the height of cut. A second end of adjustment screw **136** may engage the linkage such as cross tube **124**. For example, the second end of the adjustment screw may have a hex head **139** that engages socket **145**. Socket **145** may have a shaft that is inserted into cross tube **124** so the socket and cross tube can rotate in unison. For example, shaft **159** may be mechanically coupled to cross tube **124** with pins **157** or other fasteners engaging slots **158**. Additionally, compression spring **147** may be inserted into one end of the cross tube. The compression spring may help removal of the cross tube by sliding the cross tube over sleeve **159** until compression spring **147** is compressed sufficiently so the socket on the opposite end of the cross tube releases the hex head **139** of adjustment screw **136**.

In one embodiment, height of cut adjustment mechanism **105** may include stabilizer bar **146** that provides a linkage between the front height of cut arm **113** and rear height of cut arm **114** on each side of the deck. Each stabilizer bar **146** may be pivotably connected to rear height of cut arm **114** between axle **112** and pivot axis **119**. Each stabilizer bar **146** may be pivotably connected to front height of cut arm **113** at pivot point **129** adjacent the second or upper end **118**. The stabilizer bar on each side of the deck assures that the front height of cut arm is at the same angle and height as the rear height of cut arm. The position of the stabilizer bar on the front and rear height of cut arms also may help maintain a desired rake angle. For example, the deck may have a slight forward rake during mowing, preferably with the front of the deck about ⅛ inch lower than the back.

The invention provides an improved mechanism for adjusting the height of cut of a rotary cutting deck mounted to a lift arm of a traction vehicle. The rotary cutting deck height of cut adjustment mechanism is relatively low in cost and reduces the time and effort for maintenance and changing the cutting height.

Having described the preferred embodiment, it will become apparent that various modifications can be made without departing from the scope of the invention as defined in the accompanying claims.

The invention claimed is:

1. A rotary cutting deck height of cut adjustment mechanism, comprising:

a front height of cut arm and a rear height of cut arm, each height of cut arm pivotably mounted to a rotary cutting deck at a pivot point at an upper end of each height of cut arm;

a height of cut rod extending between the front height of cut arm and the rear height of cut arm;

a rotatable height of cut adjustment screw that extends or retracts the height of cut rod to change an angle of each height of cut arm relative to the rotary cutting deck; and

a stabilizer bar linking the front height of cut arm at the pivot point with the rear height of cut arm below the pivot point.

2. The rotary cutting deck height of cut adjustment mechanism of claim **1** wherein the height of cut adjustment screw includes a worm that engages a worm gear.

3. The rotary cutting deck height of cut adjustment mechanism of claim **1** further comprising a support pivotably mounted to an upper end of each of the height of cut arms; one of the height of cut rods extending at least partially through each support.

4. A rotary cutting deck height of cut adjustment mechanism, comprising:

a pair of front height of cut arms extending at an angle from a rotary cutting deck and supporting the rotary cutting deck on at least one rotatable ground engaging member;

a pair of rear height of cut arms extending at an angle from the rotary cutting deck and supporting the rotary cutting deck on at least one rotatable ground engaging member;

a support mounted to an upper end of each height of cut arm;

a height of cut rod between the support on each front height of cut arm and each rear height of cut arm;

a height of cut adjustment screw that extends and retracts the rod from at least one of the supports to change the angle of the height of cut arms; and

a stabilizer bar connecting each front height of cut arm at the upper end to each rear height of cut arm below the upper end.

5. The rotary cutting deck height of cut adjustment mechanism of claim **4** wherein the adjustment screw includes a worm that engages a worm gear.

6. The rotary cutting deck height of cut adjustment mechanism of claim **4** further comprising a pair of height of cut adjustment screws and a linkage connected between each adjustment screw.

7. The rotary cutting deck height of cut adjustment mechanism of claim **4** further comprising a threaded rod engaging an internally threaded portion of the height of cut rod.

* * * * *